REMARKS

Claims 1-7, 9-15, 17, 18, and new Claims 19-24 are pending in this application, after entry of this amendment.

The present invention addresses improvements in the field of metal vapor discharge lamps using alumina ceramic arc tubes which achieve color rendering and high efficiency but are also subject to color temperature changes during the lamp life, lamp turn-on failure if the light emission material contains cerium, and cracking in the sealing member. The present invention results from a discovery that by restricting the length of the electrode pins ("electrode length") and the length of the narrow tube portion to certain ranges in ratio with the lamp power and by restricting the length of the electrode pin that projects from the narrow tube portion into the discharge space ("projected electrode length") and the length of the sealing material that is inserted into the narrow tube portion ("sealing material insertion length") to certain ranges, the temperature within appropriate portions of the metal vapor discharge lamp will not become too high or too low, thus reducing color temperature changes, lamp turn-on failure, and cracking in the sealing member.

These parameters have been carefully determined and the ranges have been defined by experiments shown in our specification to provide improvements in the field of metal vapor discharge lamps with ceramic arc tubes. A proper balance of heat retention and dissipation for a particular power application to a metal vapor discharge lamp is achieved that is neither taught nor suggested by the cited references.

As can be seen in Figure 2 of our application, the electrode supporting members 23a and 23b connects with the electrodes pins 21a and 21b in the narrow tubes 12a and 12b. The outer ends of the narrow tubes are filled with sealing members 24a and 24b, for example, of a glass frit

including a metal oxide, alumina, and silica. The other ends of the narrow tube are connected to the main tube 11. The electrode pins extend into the main tube and its ends are wrapped by a coil, for example, of tungsten. The main tube contains a discharge space filled with, for example, mercury, rare gas, and light emitting metal.

In addition, the electrode length is L1 where $(0.041P + 0.5)$ mm $\leq L1 \leq (0.041P + 8.0)$ mm where P is the lamp power in W. The projected electrode length is l1 where 3.0 mm $\leq l1 \leq$ 6.5 mm. The narrow tube portion length is L2 where $(0.032P + 3.5)$ mm $\leq L2 \leq (0.032P + 8.0)$ mm and alternatively $(0.032P + 3.5)$ mm $\leq L2 \leq (0.032P + 6.0)$ mm where P is the lamp power in W. The sealing material insertion length is l2 where 3.7 mm $\leq l2 \leq 5.5$ mm.

As can be appreciated, improvements in this highly competitive field of metal vapor discharge lamps must be produced in an economical manner and have been sought by a large number of scientists and engineers. The resulting product set forth in our present invention provides such improvements, for example, color temperature change reduced by approximately half over conventional metal vapor discharge lamps.

> Thus when differences that may appear technologically minor nonetheless have a practical impact, particularly in a crowded field, the decision-maker must consider the obviousness of the new structure in this light.
>
> *Continental Can Co. USA Inc. v. Monsanto Co.*,
> 20 USPQ 2d 1746, 1752 (Fed Cir. 1991).

Claims 1, 3, and 4 were rejected under 35 U.S.C. § 102(b) as being anticipated by Geven et al ("Geven", U.S. Patent No. 5,424,609). Claims 1 and 9 were rejected under 35 U.S.C. § 102(b) as being anticipated by Juengst et al ("Juengst", U.S. Patent No. 5,484,315). Claims 1, 2, 5-7, 9-13, 15, 17, and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over

Honda et al ("Honda", U.S. Patent No. 6,215,254) in view of Sugimoto et al ("Sugimoto", U.S. Patent No. 6,208,070). The remaining rejections are moot in view of the canceled claims.

The Geven reference is a patent that provides improvements to the ability of discharge lamps to prevent corrosive attacks on current supply conductors while rendering it nevertheless possible to limit the presence of hydrogen and oxygen in the discharge vessel to a sufficient degree. The Geven reference seeks to prevent attacks on the current supply conductor by making a portion of current supply conductor halide resistant. Therefore, there are three distinct sections within the narrow tube as opposed to only two sections for our invention. First, there is a permeable current supply conductor, second, there is a halide-resistant current supply conductor, and finally, there is an electrode. The Geven reference is primarily concerned with the lengths of the halide resistant portion of the current supply conductor and the permeable portion of the current supply conductor. It is not concerned with setting limitations on the electrode length.

As shown in Figure 1, the Geven reference achieves its goals of preventing corrosive attacks on the current supply conductor by first specifying a minimum length for the halide resistant portion of the current supply conductor, L1, as the internal diameter of an end zone, D, augmented by 2 mm. (Col. 2, lines 45-48). Second, it specifies a minimum length of three times the internal diameter of the end zone, D, for the permeable portion, L2. (Col. 5, lines 35-38).

The Office Action cited Col. 8, lines 42-43 in view of Col. 11, lines 32 and 56 for the proposition that the 3 mm electrode length is within the (0.041P + 0.5) mm to (0.041P + 8.0) mm electrode length specified in our application. However, the Office Action failed to properly take into account that certain embodiments with different power consumption will render the 3 mm electrode length as being outside the range of (0.041P + 0.5) mm to (0.041P + 8.0) mm for the required electrode lengths specified in our application.

The Juengst reference is a patent that provides improvements to the method of producing a metal-halide discharge lamp with a ceramic discharge vessel. It accomplishes this by having two different ends for enclosing the discharge volume. (Figure 1 and Col. 6, lines 51-53). One end is designated the pump end and the other end is designated the blind end. (Col. 2, lines 6-15). The blind end is hermetically sealed, while the pump end "has its electrode element sealed therein while leaving a filling bore through which the interior of the discharge volume can be evacuated, and then filled with a suitable gas fill, while also being supplied with fill additives . . ." (Col. 2, lines 6-15). Thus, unlike our invention, the two ends are not identical.

Furthermore, having a coil on top of the electrode is not an essential part of the Juengst reference as Figures 1, 2, 3, and 9 show embodiments with spherical bulbs rather than coils whereas our invention is limited to electrodes with coils at its end.

Also, in manufacturing the metal-halide discharge lamp, Juengst does not provide for any substantial gap between the electrode shaft 12 and the discharge vessel end 6 (narrow tubes in our application). (Figures 2 and 3). The electrode shaft 12 is butt-welded onto the niobium prong 9, which itself is sintered onto plug 10 inside the axial bore 14, leaving substantially no gap between electrode shaft 12 and the discharge vehicle end 6. (Col 6. line 63 to Col. 7 line 2). This is different from our invention because our invention seeks to solve the problem of "the light emission metal slipping into the space between each narrow tube portion and each electrode." Without a substantial gap, that problem does not exist.

Another key deficiency within the Juengst reference is its failure to disclose the length of the discharge vessel ends 6. In contrast, the restriction of the narrow tube portion's length is a distinguishing feature of our invention. Even utilizing Figures 1 and 2 of the Juengst reference,

however, no proper inference can be made such that the length of the end will be within the narrow tube portion length specified in our invention.

The Honda reference is a patent with a primary objective of providing a high-voltage discharge lamp comprising a translucent ceramic discharge vessel, which is small and which yet has a desirable life time and a high luminous efficiency, and furthermore, a high-voltage discharge lamp device using the lamp and also a lighting apparatus using the lamp. (Col. 4, lines 5-10). The demand it seeks to satisfy is a smaller high-voltage discharge lamp having a lamp power of 20 W or less. (Col. 3, line 53 to Col. 4, line 10). The Honda reference aims to achieve this by controlling six ratios, none of which relate to the length of the electrode or any lengths in ratio with the power utilized by the lamp: R_D, $\phi H/\phi S$, d_B/d_T, L_T/L_B, R_L, and R_E. (Col. 30, line 52 to Col. 40, line 28).

As can be seen in Figure 1, R_D is the minor diameter r_s over the major diameter r_L, the ratio of which controls the shape of the bulging section 1a. (Col. 31, lines 16-20). $\phi H/\phi S$ is the ratio of the diameter of each seal part 2a, ϕH, over the diameter of each halide-resistant part 2b, ϕS, the ratio of which allows the seal part 2a to be as thick as possible. (Col. 6, lines 58 to 61).

d_B/d_T is the outer diameter of the bulging section 1a, d_B, over the outer diameter of the small-diameter cylindrical section 1b, d_T, while L_T/L_B is the length of the small-diameter cylindrical section 1b, L_T, over the length of the bulging section 1a, L_B. (Col. 8, lines 24-38). These two ratios ensure that the small-diameter cylindrical section 1b will not become too thick/thin or too short/long. (Col. 9, lines 5-28). While these ratios deal with the length of the small-diameter cylindrical section 1b, which may correspond with our narrow tube portion, the ratios d_B/d_T and L_T/L_B do not relate with the power utilized by the lamp. In our invention,

however, the length of the narrow tube portion is limited by the power utilized by the lamp shade.

R_L is the total weight of the lamp over the rated lamp power while R_E is the weight of translucent ceramic discharge vessel over the rated lamp power. While these equations utilize the lamp power, it is different from our invention because we are concerned with the lamp power in relation with the lengths of certain portions of the tube.

Furthermore, the formulas disclosed in our invention are only suitable for a power range of 70 W to 400 W as indicated by our amended claims. Since the disclosed formulas in our application would be inapplicable to a lamp utilizing less than 20 W, the high-voltage lamp disclosed in Honda is unlike the lamp disclosed in our application.

As the Office Action recognizes, the Honda reference fails to disclose the limitation of a coil being wound around the electrode at an end thereof facing the discharge space.

The Sugimoto reference was cited to teach a coil being wound around the electrode at an end thereof facing the discharge space. The Sugimoto reference, however, was interested in creating a lamp with operating characteristics that depend little on the lamp orientation. (Col. 1, lines 50-55). It achieves this primarily through limiting α, the angle between the tapered portion 14a and the central axis of an electrode 17b. (Figure 2; Col. 4, lines 14-15; Col. 5, lines 17-21).

Our invention, however, is concerned with the orientation of the lamp. It is interested in solving the problem where "the light emission material gradually slips into the spaces while the lamps are lighted." This happens "especially, when such a lamp is lighted with electrodes being held vertically . . . ." (emphasis added).

It is respectfully submitted that there is no teaching to combine these diverse references to reject our currently amended claims.

Also, even if the coils disclosed in Sugimoto were combined with Honda, the limitation of 20 W or less in the Honda reference would render the combination inapplicable to our application.

In summary, Geven teaches how to make a specific high-pressure discharge lamp. Juengst teaches a method of producing a metal-halide discharge lamp with a ceramic discharge vessel. Honda teaches how to make a high-voltage discharge lamp, high-voltage discharge lamp device, and lighting apparatus. Sugimoto teaches how to make a metal vapor discharged lamp with a specific angle between electrodes and tapped envelope wall.

Rejection Under 35 U.S.C. § 102(b)

Independent Claims 1 and 9

The present invention relates to a metal vapor discharge lamp and a lighting apparatus, and aims to prevent the light emission metal from slipping into the space between each narrow tube portion and each power transmission member, reduce the change in the color temperature even after a long, continuous lighting of the lamp, and reduce cracking within the sealing member.

To clearly show the conditions for achieving the above-mentioned objects, amended Claim 1 has the following limitations: the lamp power is in a range of 70 W to 400 W inclusive and the length of each electrode is in a range of (0.041P + 0.5) mm to (0.041P + 8.0) mm inclusive where P represents the lamp power in W.

By setting the length of each electrode to be (0.041P + 8.0) mm or less, the amount of the light emission metal that slips into the space is restricted. This enables the vapor pressure within the discharge space to be kept well within desired limits while the lamp is lighted, resulting in a

metal vapor discharge lamp that shows less change in the color temperature and in other characteristics even after a long, continuous lighting of the lamp.

On the other hand, setting the length of each electrode to be (0.041P + 0.5) mm or more provides the advantageous effects of suppressing a reaction between the sealing member and the light emission metal, and of preventing cracks from occurring in the sealing member.

The Geven reference, however, has many embodiments including versions that consume 70 W, 50 W, or 20 W while possessing a 3 mm electrode. While the Office Action cited to the 50 W and 20 W embodiments as being within the (0.041P + 0.5) mm to (0.041P + 0.8) mm range specified in Claim 1, it failed to take into account the 70 W embodiment. When the lamp power P is 70 W, the equation (0.041P + 0.5) mm takes the value of 3.37 mm and the equation (0.041P + 0.8) mm takes the value of 3.67. As a result, the 3 mm electrode length disclosed in Col. 8, lines 42-43 of the Geven reference is out of the 3.37 mm to 3.67 mm range specified by Claim 1.

The Juengst reference teaches a method for producing a metal-halide discharge lamp with a ceramic discharge vessel. However, the metal-halide discharge lamp it teaches is materially different from our invention.

Judging from Figures 2 and 3 of the reference, and the description thereof that the electrode shaft 12 is butt-welded onto the niobium prong 9, which is sintered directly onto plug 10 via the axial bore to act as a lead-through (electrode supporting member), there is substantially no gap between the electrode shaft 12 and the discharge vehicle end 6 (narrow tube portions). (Col. 6, line 65 to Col. 7, line 2). A metal vapor discharge lamp that has substantially no gap between each narrow tube portion and each electrode as disclosed in the Juengst reference is irrelevant to the problem addressed by the present invention: "the light emission metal slipping into the space between each narrow tube portion and each electrode." In our

invention, for example, the electrode pins used in our experiments had a diameter of 0.71 mm while the narrow tube portion had an inside diameter of 1.3 mm. This provides a gap, for example, of 0.59 mm. With respect to the preferred embodiment in Figure 3 of the Juengst reference the electrode shaft 12 has a diameter of 0.75 mm while the niobium prong 9 has a diameter of 0.8 mm. (Col. 7, lines 20-27). This provides for a gap width of 0.05 mm. Our gap width, for example, of 0.59 mm is substantially greater than the 0.05 mm gap provided in the Juengst reference. Furthermore, the electrode shaft 12 extends 0.5 mm deep into the axial bore 14 providing a gap of the same depth. (Col. 7, line 26). In our invention, for example, the gap, G, is approximately a distance of 2.04 mm deep as given by the length of the narrow tube, L2, minus the depth of the sealing material 11 where the lamp consumes 70 Watts. Therefore, the Juengst reference uses a gap of 0.05 mm wide by 0.5 mm deep while our invention uses a gap, for example, of 0.59 mm wide by 2.04 mm deep. As apparent from this, the metal vapor discharge lamp of Claim 1 is different in the basic structure from that disclosed in the Juengst reference.

We accordingly believe that Claim 1 has novelty over the Geven and Juengst reference.

Independent Claim 9

Amended Claim 9 has the following limitations: the lamp power is in a range of 70 W to 360 W inclusive and the length of each electrode is in a range of (0.032P + 3.5) mm to (0.032P + 8.0) mm inclusive.

By setting the length of each narrow tube portion to be (0.032P + 8.0) mm or less, the amount of the light emission metal that slips into the space is restricted. This enables the vapor pressure within the discharge space to be maintained while the lamp is lighted, resulting in a

metal vapor discharge lamp that shows less change in the color temperature and in other characteristics even after a long, continuous lighting of the lamp.

Also, setting the length of each narrow tube portion to be (0.032P + 3.5) mm or more in Claim 9 provides the advantageous effects of suppressing the reaction between the sealing member and the light emission metal, and of preventing cracks from occurring in the sealing member.

In contrast, the Juengst reference does not disclose the length of the end 6 (called the narrow tube portion in our invention) of the discharge vessel 4. Therefore, the feature of Claim 9: "a length of each narrow tube portion is in a range of (0.032P + 3.5) mm to (0.032P + 8.0) mm inclusive" is not disclosed in the Juegnst reference.

The end 6 cannot also be properly inferred to be within the narrow tube portion ranges specified in our invention. The Juengst reference discloses that the metal-halide discharge lamp has the power of 150 W (Col. 6, lines 26-27), and that the plug 10 is 3.3 mm long (Col. 6, lines 63-65). According to Figure 1 and Figure 2, the end 6 looks to be approximately the same size as the plug 10. According to Claim 9 of our invention, the acceptable range for the narrow tube is (0.032P +3.5) mm to (0.032P + 8.0) mm inclusive, which is 8.3 mm to 12.8 mm given a 150 W power consumption. If the end 6 is as long as plug 10, 3.3 mm, the length of the end 6 is well out of the 8.3 mm to 12.8 mm range defined in Claim 9.

We accordingly believe that Claim 9 has novelty over the Juengst reference.

Dependent Claims 3 and 4

In view of the explanations above, Claims 1 and 9 have novelty and inventiveness. Accordingly, the claims dependent from these independent claims also are allowable.

Rejections Under 35 U.S.C. § 103(a)

Independent Claims 1, 9, 10, 17, and 18

Our invention utilizes electrode lengths within the range of (0.041P + 0.5) mm to (0.041P + 8.0) mm inclusive and narrow tube lengths within the range of (0.032P + 3.5) mm to (0.032P + 8.0) mm inclusive or alternatively (0.032P +3.5) mm to (0.032P + 6.0) mm inclusive for a metal vapor discharge lamp that operates between 70 W to 400 W. Furthermore, it has a coil wound around the electrode facing the discharge space.

The Honda reference, however, is for a lamp that utilizes less than 20 W of power, which is significantly less than the 70 W to 400 W that our invention operates on. This is apparent from the following statement in the Honda reference: "There is a demand, however, for a smaller high-voltage discharge lamp having a lamp power of 20 W or less . . . The main object of the present invention is to provide a high-voltage discharge lamp comprising a translucent ceramic discharge vessel, which is small and which yet has a desirable life time and a high luminous efficiency, and to provide a high-voltage discharge lamp device using the lamp and also a lighting apparatus using the lamp." (Col. 3, line 52 to Col. 4, line 10).

It is clear that the conditions disclosed in the present invention need to be changed in order for them to properly work for lamps with different types of electrodes or different levels of lamp power, to achieve the object of the present invention of preventing the light emission metal from slipping into the space between each narrow tube portion and each power transmission member, preventing lamp turn-on failure, and preventing cracks from occurring in the sealing member.

More specifically, the conditions indicated with the formula of the present claims are suitable for the lamps with the lamp power range from 70 W to 400 W, but not for the lamps with the lamp power of 20 W or less.

Even if the coil disclosed in the Sugimoto reference is provided in the high-voltage discharge lamp disclosed in the Honda reference, the advantageous effects of the present invention would not be gained since the lamp power of the resulted lamp is still 20 W or less.

The combination of references fails to provide a teaching reference to suggest the combination relied upon to reject our claims. As can be seen in the case of *Al-Site Corp. v. VSI International*, 174 F.3d 1308 (Fed. Cir. 1999) at page 1324:

> VSI is unable, however, to point to any specific teaching or suggestion for making this combination. VSI instead relies on what it presumes is the level of knowledge of one of ordinary skill in the art at the time of the invention to supply the missing suggestion to combine. In the first place, the level of skill in the art is a prism or lens through which a judge or jury views the prior art and the claimed invention. This reference point prevents these deciders from using their own insight or, worse yet, hindsight, to gauge obviousness. Rarely, however, will the skill in the art component operate to supply missing knowledge or prior art to reach an obviousness judgment. See W.L. Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983) ("To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher."). Skill in the art does not act as a bridge over gaps in substantive presentation of an obviousness case, but instead supplies the primary guarantee of objectivity in the process. See Ryko Mfg. Co. v. Nu-Star, Inc., 950 F.2d 714, 718, 21 USPQ2d 1053, 1057 (Fed. Cir. 1991).
>
> (Underline added.)

We accordingly believe that Claims 1, 9, 10, 17, and 18 of the present invention are not obvious from the combination of the Honda and Sugimoto reference.

Dependent Claims 2-7 and 11-15

In view of the explanations set forth above, independent Claims 1, 9, 10, 17, 18 and new Claim 19 have novelty and inventiveness over the cited references. Accordingly, the claims dependent from these independent claims also are allowable by adding additional features.

Conclusion

It is believed that the case is now in condition for allowance and an early notification of the same is sought.

If the Examiner believes that a telephone interview will help further the prosecution of this case, he is respectfully requested to contact the undersigned attorney at the listed telephone number.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on June 21, 2005.

By: Sharon Farnus

Signature

Dated: June 21, 2005

Very truly yours,

SNELL & WILMER L.L.P.

Joseph W. Price
Registration No. 25,124
1920 Main Street, Suite 1200
Irvine, California 92614-7230
Telephone: (949) 253-4920